SPLITTING OF KRAFT MILL GREEN LIQUOR USING A SNAKE-CAGE POLYELECTROLYTE RESIN

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ABSTRACT

A Recoflo® fixed-resin bed system employing an amphoteric snake-cage polyelectrolyte resin was used to separate green liquor (a solution of mainly sodium carbonate and sodium hydrosulfide) from kraft pulp mills into sodium hydrosulfide-rich and sodium carbonate/ hydroxide-rich components. The system was operated in two main steps: sodium hydrosulfide uptake (sorption) and elution of sodium hydrosulfide by water (desorption). Depending on the conditions used, the separation efficiencies ranged from 80 to 96% for sodium hydrosulfide, 90 to 95% for sodium carbonate and 74 to 92% for sodium hydroxide.

Even though green liquor contains no oxidants capable of de-crosslinking the resin, it contains hydrosulfide ion (HS^-), which is a powerful nucleophilic agent under alkaline conditions. For this reason, the degradation of this resin was studied under static and dynamic conditions, by measuring the loss in anion-exchange capacity and the degree of capacity utilization over time. In static tests, the resin was exposed continuously to a mill green liquor at four different temperatures. After 360 days, the total anion-exchange capacity dropped by about 15% at room temperature and by 30% at 35°C. Dynamic resin durability tests over a period of 90 days showed that the resin is able to maintain performance even after a loss of 33% in the anion-exchange capacity. Elemental nitrogen and sulphur analyses of the resin as well as trimethylamine and methyl mercaptan analyses in the product solution suggest that the resin is degrading through the nucleophilic substitution of quaternary ammonium groups with HS^- to form thiol groups and trimethyl-amine. This mechanism is consistent with the thermal degradation of anion-exchange resins in the hydroxide form through nucleophilic attack by hydroxide ions.